

CLAIMS

1. A high frequency electrical signal control device, comprising a transmitter for generating a high frequency electrical signal, a receiver, a
5 transmission line for propagating the electrical signal, and a structure for radiating the electrical signal propagated through the transmission line to the space or receiving a signal from the space,

wherein a degree of coupling of the electrical
10 signal between the space and the transmission line provided by the structure can be variably controlled.

2. A high frequency electrical signal control device, comprising a transmitter for generating a high frequency electrical signal, a receiver, a
15 transmission line for propagating the electrical signal, and a structure for radiating the electrical signal propagated through the transmission line to the space or receiving a signal from the space,
wherein:

20 the structure has a movable portion; and
directivity of an electromagnetic wave radiated to the space can be controlled in deflection.

3. A high frequency electrical signal control device according to claim 1, wherein an antenna is
25 provided as the structure so that intensity or directivity of an electromagnetic wave radiated or received through the antenna can be made variable.

4. A high frequency electrical signal control device according to claim 1, wherein:

the transmission line is a microstrip line, a co-planar line, or a co-planar strip line constituted
5 by a plane circuit; and

the structure is formed on the plane circuit.

5. A high frequency electrical signal control device according to claim 4, wherein:

a movable portion for turning ON/OFF an
10 electrical contact is provided, the movable portion being formed on the plane circuit; and

a degree of coupling of the signal between the structure and the space can be variably controlled by the movable portion.

15 6. A high frequency electrical signal control device according to claim 3, wherein:

the transmission line is a waveguide having a rectangular or circular cavity;

the antenna is a horn antenna having a similar
20 cavity; and

it is possible to carry out at least one of an operation for changing a positional relationship between an input portion of the horn antenna and the waveguide to change the magnitude of the degree of
25 coupling, and an operation for changing a direction of an output unit of the horn antenna to carry out scanning for the directivity of an electromagnetic

wave radiated to the space.

7. A high frequency electrical signal control device according to claim 3, wherein a photonic crystal or a lens is integrated on a surface of the antenna to emit an electromagnetic wave having high
5 directivity through a narrow-emission angle.

8. A high frequency electrical signal control device according to claim 1, wherein a circulator is integrated in the transmission line such that an
10 electrical signal is caused to flow in one direction among the transmitter, the receiver, and the structure connected to the transmission line.

9. A high frequency electrical signal control device according to claim 1, wherein a frequency
15 ranging from a millimeter wave band to a terahertz wave band (30 GHz to 30 THz) is used as a frequency of the high frequency electrical signal.

10. A high frequency electrical signal control device according to claim 1, wherein the transmitter
20 and the receiver are integrated on the same substrate.

11. A high frequency electrical signal control device according to claim 1, wherein:

the transmitter for generating the high frequency electrical signal applies a pulse laser
25 beam to a gap defined between two conductors which are provided on a surface of a photoconductive film and across which a voltage is applied;

the receiver obtains an electrical signal from a current caused to flow between the two conductors in the same construction;

the reception can be carried out only at a
5 timing when a part of the same pulse laser beam is applied to the gap between the two conductors of the receiver; and

means for allowing control of an amount of beam delay is provided in the middle of an optical path
10 through which the pulse laser beam is guided to the receiver.

12. A high frequency sensing system, wherein propagation of an electromagnetic wave through the space is controlled using the high frequency
15 electrical signal control device as claimed in claim 1 to wirelessly inspect constituent elements, a permittivity distribution state, positional information, and the like of a surface or an inside of an object.

20 13. A high frequency electrical signal control device, comprising a generator for generating a high frequency electrical signal which serves as an element for converting a laser beam into an electromagnetic wave having a frequency lower than
25 that of the laser beam,

wherein a laser device for generating a laser beam, an optical waveguide for propagating the laser

beam to guide the laser beam to a generator, the generator, and a transmission line for propagating the signal are integrated on the same substrate.

14. A high frequency electrical signal control
5 device according to claim 13, wherein the generator has a waveguide type structure so as to be coupled to the optical waveguide for propagating the laser beam.

15. A high frequency electrical signal control
10 device according to claim 13, wherein a detector and a transmission line for propagating the signal to the detector are further integrated on the same substrate.

16. A high frequency electrical signal control
15 device according to claim 14, wherein a dielectric member constituting the optical waveguide and a dielectric insulating layer constituting the transmission line are formed of the same member.

17. A high frequency electrical signal control device according to claim 13, wherein:

the laser device includes two devices having
20 different oscillation wavelengths;

beams emitted from the two devices are mixed with each other in a Y-branch optical waveguide formed on the same substrate; and

an electrical signal having a frequency
25 corresponding to a difference in frequency between the two devices is generated from the generator.

18. A high frequency electrical signal control

device according to claim 13, wherein:

the laser device is comprised of a semiconductor mode lock laser adapted to generate a short pulse having a pulse width of equal to or
5 shorter than 10 psec; and

an electrical signal of a short pulse is generated by the generator.

19. A high frequency electrical signal control device according to claim 18, wherein:

10 an optical output of the semiconductor mode lock laser can be guided to the detector as well through the optical waveguide formed on the same substrate;

the optical waveguide for guiding the optical
15 output of the semiconductor mode lock laser to the detector is provided with an optical delay unit for changing an amount of delay; and

a time waveform of the electrical signal of the short pulse is measured while the amount of delay is
20 changed.

20. A high frequency electrical signal control device according to claim 13, further comprising an antenna capable of radiating/receiving an electromagnetic wave to/from the space, the antenna
25 being provided in the transmission line.

21. A high frequency electrical signal control device according to claim 20, further comprising

means for deflecting a direction of the
electromagnetic wave radiated from the antenna.

22. A high frequency electrical signal control
device according to claim 13, wherein a frequency
5 ranging from a millimeter wave band to a terahertz
wave band (30 GHz to 30 THz) is used as a frequency
of the high frequency electrical signal.

23. A high frequency sensing system, wherein
constituent elements, a permittivity distribution
10 state, positional information, and the like of a
surface or an inside of an object placed on the
transmission line for propagating the electrical
signal are measured using the high frequency
electrical signal control device as claimed in claim
15 13.

24. A high frequency sensing system, wherein
propagation of an electromagnetic wave through the
space is controlled using the high frequency
electrical signal control device as claimed in claim
20 20 to wirelessly measure constituent elements, a
permittivity distribution state, positional
information, and the like of a surface or an inside
of an object.